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IS 3331 (2007): Copper and brass strips/foils for radiator cores [MTD 8: Copper and Copper Alloys]

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विशिष्टि

(दूसरा पुनरीक्षण)

Indian Standard

COPPER AND BRASS STRIPS/FOILS FOR RADIATOR
CORES — SPECIFICATION

(*Second Revision*)

ICS 77.150.01

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Copper and Copper Alloys Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1965 and subsequently revised in 1977. While reviewing this standard in the light of experience gained during these years, the Committee decided to revise it in line with present practice being followed by Indian industry. In the present revision, following modifications have been made:

- a) A new clause on references has been incorporated.
- b) Clause for freedom from defects has been modified.
- c) New grades have been added in Table 1 and Table 2 on chemical composition.
- d) Table 3 on hardness has been modified.
- e) A new clause on flatness has been added.
- f) Requirement of test certificate is added.
- g) Marking clause has been modified.

The composition of the Committee responsible for the formulation of this standard is given in Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (revised)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

COPPER AND BRASS STRIPS/FOILS FOR RADIATOR CORES — SPECIFICATION

(Second Revision)

1 SCOPE

This standard covers the requirements for copper and brass strips/foils for fabrication of radiators for motor cars, trucks, tractors, earth moving equipments, diesel locomotives and stationary internal combustion engines.

2 REFERENCES

The following standards contain provisions, which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS No.</i>	<i>Title</i>
1387 : 1993	General requirements for the supply of metallurgical materials (<i>second revision</i>)
3186 : 1965	Method of chemical analysis of cadmium copper
3288 : 1986	Glossary of terms relating to copper and copper alloys
3685 : 1966	Method of chemical analysis of brasses
4748 : 1988	Method for estimating the average grain size of wrought copper and copper alloy

3 TERMINOLOGY

For the purpose of this standard following definitions reproduced from IS 3288 shall apply.

3.1 Strip — Flat product over 0.15 mm, thick and up to and including 10 mm, thick of any width and generally not cut to length; usually in coils but may be flat or folded.

3.2 Foil — A flat product of thickness up to and including 0.15 mm, of any width generally not cut to length usually in coil form but may also be in flat or folded form.

4 SUPPLY OF MATERIAL

The general requirements relating to supply of material are laid down in IS 1387.

5 MANUFACTURE

The material manufactured by cold-rolling shall be supplied in annealed (O), half hard (HB) or hard (HD) temper condition.

6 FREEDOM FROM DEFECTS

6.1 Surface of the material shall be clean and free from oxides, pin holes, blisters, flakes, scratches and other harmful defects. The edges slitted/unslitted of strips/foils should be free from edges burrs and cracks.

6.2 The surface of the material shall be free from contaminants which would prevent satisfactory wetting and bonding of soldier joints under normal production condition.

7 CHEMICAL COMPOSITION

The material shall have the composition as given in Tables 1 and 2.

8 PHYSICAL PROPERTIES

8.1 Hardness

The hardness of copper and brass strip/foil shall be as specified in Table 3.

8.2 The average grain size and the limits of variation for annealed temper shall be as agreed to between the purchaser and the supplier.

8.2.1 The average grain size may be estimated by comparing photo-micrographs shown in IS 4748.

9 DIMENSIONS AND TOLERANCES

The copper and brass strip/foil shall be supplied in the thickness and widths specified by the purchaser subject to tolerances given in Table 4.

10 FLATNESS

The strip shall be free from wavers and buckles. This is checked by unrolling the strip on to a plain surface.

11 STRAIGHTNESS

11.1 The strip and foil shall be supplied with straight parallel edges.

11.2 The slit edge shall be free from burrs and frilling.

Table 1 Chemical Composition of Copper Strips/Foils
(Clause 7)

Sl No.	Material	Percent						Chemical Analysis
		P	Ag	Cd	Sn	Other Impurities	Cu	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
i)	Silver bearing copper	0.015-0.045 0.08	0.03 —	—	—	0.05, Max	99.5, Min	To be mutually agreed between the supplier and the purchaser
ii)	Cadmium copper	—	—	0.05-0.2	—	0.05, Max	Remainder	To be carried in accordance with IS 3186
iii)	Tin bearing copper	0.015-0.045	—	—	0.07-0.2		99.5, Min	To be mutually agreed between the supplier and the purchaser

NOTE — Keep phosphorous at lower limit when tin is towards higher limit.

Table 2 Chemical Composition of Brass Strips/Foils
(Clause 7)

Sl No.	Material	Percent						Chemical Analysis
		Cu	Pb	Fe	Sn	Total Other Impurities	Zn	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
i)	Grade I	68.5-71.5	0.02, Max	0.05, Max	0.03, Max	0.2, Max	Remainder	To be carried out in accordance with IS 3685
ii)	Grade II	64.5-67.0	0.03, Max	0.05, Max	0.05, Max	0.3, Max	Remainder	do
iii)	Grade III	61.5 -64.5	0.05, Max	0.075, Max	0.075, Max	0.6, Max	Remainder	do

Table 3 Hardness of Copper and Brass Strip/Foil
(Clause 8.1)

Sl No.	Temper	Copper HV		Brass HV
		(1)	(2)	
i)	O(A)		60, Max	85, Max
ii)	HB		—	100-130
iii)	½ H		—	130-150
iv)	HD		105-125	—
v)	EH		125-145	—

NOTE — For guidance, a table giving correlation between load and Vickers hardness obtained for various thickness is included in Annex A.

Table 4 Tolerance for Copper and Brass Strips/Foils

(Clause 9)

Sl No.	Thickness (1)	Thickness (2)	Normal (3)	Tolerance (4)	Width (5)	Width Tolerance	
						Normal (6)	Close (7)
i)	Up to and including 0.16 mm		± 7 percent of the thickness	± 0.003 mm	Up to 100 mm	± 0.1 mm	± 0.075 mm
ii)	Over 0.16 mm and up to 0.25 mm		± 0.011 mm $+3$ percent of thickness	± 0.005 mm	Over 100 mm Up to 310 mm	± 0.15 mm	± 0.100 mm

12 EDGE-WISE CURVATURE (DEPTH OF ARC)

In any length or width of one meter of the material, the depth of arc shall not exceed 2 mm.

13 SAMPLING AND RETEST

13.1 Samples of copper and brass strips/foils of the same composition, width, thickness and temper shall be batched together. For each batch, the number of samples taken shall be as given in Table 5.

13.2 Retests

Should any one of the pieces first selected by the purchaser or his representative fail to pass any of the prescribed tests, two further samples from the same batch shall be selected for testing, one of which shall be free from the strip or foil from which the original test sample was taken, unless that strip or foil has been withdrawn by the supplier. Should the test piece from both these additional samples pass, the batch represented by the test samples shall be deemed to have complied with this standard. Should the test piece from either of these additional samples fail, the batch represented by the test samples shall be deemed not to comply with this standard.

14 DELIVERY

14.1 Each coil shall not contain more than two lengths of strip.

14.2 The internal and external diameter of the coil and the minimum mass of each coil shall be mutually agreed to between the supplier and the purchaser.

15 PACKING

15.1 Coils shall be packed in such a way as to protect

them against;

- a) ingress of moisture and other elements which are likely to cause surface tarnishing and damage,
- b) damage of slit edges,
- c) collapse of the inner diameter, and
- d) unwinding of the strips from the coil while taking out the box and during handling.

15.2 Where coils have to be transported, they shall be securely packed in strong wooden cases to resist breakage of packing during handling and transit.

16 MARKING

16.1 Each coil shall be marked with the grade of the material, size, temper, name of the manufacturer, net and gross mass.

16.1.1 BIS Certification Marking

The material may also be marked with the Standard Mark.

16.1.1.1 The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

17 TEST CERTIFICATE

The manufacturer/supplier shall provide test certificate for each consignment giving information like lot number, coil number, corresponding chemical composition, tensile test, compression test, etc.

Table 5 Sampling and Retest

(Clause 13.1)

SI No.	Number of Coils of Foil or Strip in the Lot	Number of Coils of Foil or Strip to be Selected
(1)	(2)	(3)
i)	Up to 15	5
ii)	16-25	8
iii)	26-50	13
iv)	51-100	20
v)	101-150	32
vi)	151-300	50
vii)	301-500	80
viii)	501 and above	125

NOTE — The samples shall be cut off cold and shall receive no further treatment except that they may be machined to the shape of the test piece before being tested.

ANNEX A

(Table 3)

CORRELATION BETWEEN VICKERS HARDNESS AND LOAD FOR VARIOUS THICKNESSES OF COPPER AND BRASS STRIPS/FOILS

Thickness mm	Vickers Hardness (HV)	Load g	Thickness mm	Vickers Hardness (HV)	Load g
(1)	(2)	(3)	(1)	(2)	(3)
0.05	50-80	25	0.15	40-55	200
	81-150	50		56-85	300
	151-300	100		86-170	500
				171-350	1 000
0.06	50-110	50	0.16	45-75	300
	111-120	100		76-150	500
0.07	50-80	50	0.17	151-350	1 000
	81-160	100		40-65	300
	161-230	200		66-130	500
0.08	40-60	50	0.18	131-260	1 000
	61-120	100		40-60	300
	121-180	200		61-120	500
0.09	50-95	100	0.19	121-240	1 000
	96-140	200		35-55	300
	141-260	300		56-105	500
0.10	40-75	100	0.20	106-210	1 000
	76-110	200		50-95	500
	111-190	300		96-190	1 000
0.11	40-65	100	0.21	50-80	500
	66-95	200		81-190	1 000
	96-160	300		45-75	500
	161-300	500		76-170	1 000
0.12	40-55	100	0.22	40-70	500
	56-80	200		71-140	1 000
	81-130	300		141-300	2 000
	131-260	500			
0.13	50-70	200	0.24	40-65	500
	71-115	300		66-130	1 000
	116-230	500		131-300	2 000
0.14	40-60	200	0.25	40-65	500
	61-100	300		66-130	1 000
	101-200	500		131-300	2 000

ANNEX B*(Foreword)***COMMITTEE COMPOSITION****Copper and Copper Alloys Sectional Committee, MTD 8**

<i>Organization</i>	<i>Representative(s)</i>
Indian Copper Development Centre, Kolkata	DR D. D. SARKAR (<i>Chairman</i>)
Agarwal Metal Works, Rewari	SHRI D. K. JAIN
Alcobex Metals Ltd, Jodhpur	SHRI O. P. RANA (<i>Alternate</i>)
All India Air Conditioners & Refrigeration Association, Delhi	SHRI G. C. KANUNGO
Bhabha Atomic Research Centre, Mumbai	SHRI S. D. PUROHIT (<i>Alternate</i>)
Bharat Electronics Ltd, Bangalore/Ghaziabad	SHRI A. H. GIDWANI
Bharat Heavy Electricals Ltd, Bhopal	SHRI A. P. KHURANA (<i>Alternate</i>)
Birla Copper Ltd, Bharuch	SHRI V. K. TANGRI
Crompton Greaves Ltd, Mumbai	SHRI S. K. GUPTA (<i>Alternate</i>)
DGS&D (Quality Assurance Wing), Kolkata/New Delhi	SHRI SRIDHAR S. NADIGER
Finolex Cable Ltd, Bangalore	SHRI ANUJ SINGH (<i>Alternate</i>)
Gem Sanitary Appliances P Ltd, Delhi	REPRESENTATIVE
Hindustan Cables Ltd, Burdwan	SHRI CHAKARVARTI
Hindustan Copper Ltd, Kolkata	SHRI B. M. SHARMA (<i>Alternate</i>)
India Govt Mint, Hyderabad	REPRESENTATIVE
Indian Telephone Industries Ltd, Bangalore	SHRI B. DAS GUPTA
Indoswe Engineers Pvt Ltd, Pune	SHRI S. K. PANDEY (<i>Alternate</i>)
International Copper Promotion Council (India), Mumbai	REPRESENTATIVE
Larsen & Toubro Ltd, Mumbai	SHRI V. K. CHOWDHARY (<i>Alternate</i>)
Ministry of Defence (DGQA), Ambernath	SHRI A. K. NAG
Ministry of Defence (OFB), Kolkata	SHRI P. N. GANGOPADHYAY
Ministry of Defence (DMRL), Hyderabad	SHRI M. J. RAY
Ministry of Railways (RDSO), Lucknow	SHRI V. V. PRABHU
National Metallurgical Laboratory, Jamshedpur	SHRI MD. DAWOOD (<i>Alternate</i>)
National Test House, Kolkata	SHRI U. K. JATIA
	SHRI S. K. JAIN (<i>Alternate</i>)
	SHRI NAVNEEN SHUKLA
	SHRI NARSIMHAN (<i>Alternate</i>)
	SHRI R. C. AGARWAL
	SHRI U. R. JOSHI (<i>Alternate</i>)
	SHRI P. C. GUPTA
	SHRI R. K. VARSHNEY (<i>Alternate</i>)
	SHRI R. S. SINGH
	SHRI P. S. BANDHOPADHYAY (<i>Alternate</i>)
	DR S. NAGARJUNA
	SHRI A. K. MANDAL
	SHRI S. K. DAS (<i>Alternate</i>)
	DR T. S. N. SANKARNARAYAN
	SHRI K. K. GUPTA (<i>Alternate</i>)
	DR SHYAMAL KR. SAHA
	SHRI ASHOKE BASU (<i>Alternate</i>)

<i>Organization</i>	<i>Representative(s)</i>
National Wire and Metal Industries, Mumbai	SHRI HASMUKH R. MEHTA SHRI S. R. RAJYAGOR (<i>Alternate</i>)
Ordnance Factory, Katni	DR A. S. BALGIR SHRI J. Z. WARKADE (<i>Alternate</i>)
Rapsari Engineering Industries Ltd, Bangalore	DR P. SRIRAM SHRI K. N. GANAPATHY (<i>Alternate</i>)
Regional Research Laboratory, Thiruvananthapuram	DR T. PRASAD RAO
Saru Copper Alloy Semis Pvt Ltd, Meerut	SHRI D. P. JAIN SHRI SANJEEV JAIN (<i>Alternate</i>)
Sterlite Industries India Ltd, Mumbai	SHRI BAL CHANDRA KAMAT SHRI A. N. CHAKRAVORTHY (<i>Alternate</i>)
The Indian Smelting & Refining Co, Mumbai	SHRI D. BHATTACHARYA SHRI M. P. SAHLOT (<i>Alternate</i> I) SHRI V. D. KELUSKAR (<i>Alternate</i> II)
The Institute of Indian Foundrymen, Ghaziabad/New Delhi	SHRI K. S. SATYANARAYANA SHRI A. K. ANAND (<i>Alternate</i>)
Vanaz Engineers Pvt Ltd, Pune	SHRI S. K. KHANDEKAR SHRI K.P. VELAYUDHAN (<i>Alternate</i>)
Volta's Ltd, Thane	SHRI P. D. RAO
BIS Directorate General	SHRI S. K. GUPTA, Scientist 'F' & Head (MTD) [Representing Director General (<i>Ex-officio</i>)]

Member Secretary
SHRI DEEPAK JAIN
Scientist 'E' (MTD), BIS

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